1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

222 [114] 241 462

During untold centuries in which they collected plant matter, women acquired an intimate knowledge of vegetable life. Eduard Hahn [illegible] others have therefore reasoned that women were the inventors of the cultivation of plants and hence were the first food producers. Hahn has given the name *Hackbau* (hoe culture or hoe tillage) to primitive cultivation, and maintains that the hoe is woman's implement; he draws a sharp distinction between Hackbau and more advanced cultivation, which he calls *Pflugbau* (plow culture or plow tillage) and ascribes to men.[9] It is indeed true that men generally farm with plows and that many examples may be cited of women using hoes; nevertheless, there are so many instances of male primitive cultivators employing hoes or similar instruments that Hahn's classification should be modified. While there seems to be no reason for abandoning his theory of the invention of plant cultivation by women, the classification of cultivation by tools, such as the hoe and the plow, ascribed to one sex or the other, is unsatisfactory. For, in spite of the fact that the collection of vegetable matter is almost exclusively the woman's task in the gathering economy, among primitive cultivators men either assist women in the cultivation of plants or entirely take over this activity whenever hunting or fishing become less important than soil tillage. Furthermore, many primitive cultivators do not use the hoe, but continue to employ the digging stick, characteristically used by the food-gathering women. From Formosa southward throughout the Malay Archipelago, as well as on the mainland of Southeastern Asia, the digging stick, also known as the dibble stick or planting stick, is frequently used by the primitive cultivator. On the other hand, there are advanced cultivators who till their land intensively with hoes; they use manure, rotate their crops, terrace fields that lie on slopes, and practice irrigation, yet they do not use plows drawn by draft animals (however, in some instances they have livestock). In other words, advanced agriculture does not depend upon the animal-drawn plow nor does primitive agriculture depend upon the hoe.

[101] [105]

A more fundamental distinction between primitive and advanced agriculture may be made in terms of land use rather than of tools. Primitive cultivators, with the possible exception of those living in arid regions, raise one or two crops on a given plot of land, then abandon the plot and make a new field, preferably in the forest, so that the old plot lies fallow sometimes for many years and may itself revert to forest; in short, primitive cultivators shift the place of their agricultural activities with regularity. The crop land consists of small patches scattered throughout the forest; these patches are extremely ragged in appearance and do not look at all like fields. A primitive cultivator would never think of removing stumps and fallen trees; instead, he deliberately raises his crop among them. This kind of cultivation is best described as shifting-field, or shift-

241 311

[9] Hahn: Das Alter der wirtschaftlichen Kultur, 1905; idem: Die Entstehung der Pflugkultur, 1909; idem: Von der Hacke zum Pflug, 1914; Kolff: "Hahn's hypothese," 1926, pp. 884–907.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL

ing, cultivation. In contrast to this method, advanced agriculture is practiced year after year on the same well tended plot, the fertility of which is maintained by manuring, crop rotation, intensive cultivation, terracing, and often the regular addition of mineral matter in the form of silt deposited on the land by irrigation water. Only occasionally may the land be allowed a short fallow period. This type of tillage may be called permament-field, or sedentary, cultivation.[10]

Shifting cultivation and sedentary cultivation are generic terms used to describe fundamental differences in land use, differences that find their outward expression in the cultural landscape created by those who maintain these economies.[11] Can there be a greater contrast than that between the shifting cultivators' small, irregular, temporary clearings with their chaotic jumble of fallen and half-fallen tree trunks and stumps, on the one hand, and, on the other, an irrigated plain, subdivided into small fields, each surrounded by a dyke—or a steep slope where a succession of beautifully built terraces leads up for several hundreds or even thousands of feet? These kinds of landscape are physical expressions of totally different economies, or modes of life, with different cultural patterns, concepts of land tenure, attitudes toward the soil, and material equipment.

Historically, shifting cultivation without doubt antedates sedentary cultivation, which requires among other things more elaborate techniques and deeper insight into the relationships between soil, tillage, and yields.

Shifting and sedentary cultivation may each be further classified in terms of tools, as we have seen, or in terms of crops, systems of rotation, and the like.[12] For instance, in terms of crops, we may distinguish between grain and grainless culture. Of the two, grainless culture is generally conceded to be the older. One argument for this thesis is that fruits and many of the root and leaf crops may be eaten raw or simply prepared, whereas cereals require more elaborate preparation. The fact that grainless agriculture is largely confined to the fringes of Southeastern Asia also supports the thesis that, at least in this region, grainless agriculture preceded the cultivation of cereals. Still further substantiation is found in Polynesia, where the inhabitants cultivated no cereals when they were first visited

[10] Although sedentary cultivation is commonly practiced by people who use plows drawn by animals, there are large areas where it is practiced with little or no use of the plow. Such areas are found in parts of the Philippines, Java, Sumatra, and southern China, where steep hillsides have been terraced and where the nature of the terrain makes the use of work animals impossible. Sometimes individual farms or patches of land are so small that they must be tilled with hoes, even though plows may be used on adjacent farms. In places custom and religious tradition forbid the use of plows and draft animals.

[11] Waibel: Probleme der Landwirtschaftsgeographie, 1933, p. 11.

[12] For example, we may distinguish: (a) shifting dibble cultivation, shifting hoe cultivation, and shifting plow cultivation; (b) grainless shifting cultivation and shifting grain cultivation; (c) shifting field-forest cultivation and shifting field-grass cultivation; (d) permanent plow cultivation and permanent planting-stick cultivation; (e) permanent four-field cultivation, and so on. Not all of these are found in Southeastern Asia.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

part of the government and of missionaries to introduce terracing and wet-rice cultivation but, instead, continue to practice shifting cultivation and to depend upon dry rice as their staple food.

Wherever we find shifting cultivation the density of population is low; on the other hand, permanent cultivation provides the basis for higher densities. The higher the density, the greater is the care bestowed upon the cultivation of the soil. The development of permanent-field cultivation, the construction of terraces on mountainsides and hillsides, the dyking and draining of plains, and other complex techniques associated with wet-rice cultivation are but expressions of a population density that demands an intensive utilization of the soil and a maximum production of food crops.

The areas where wet rice was first cultivated were probably hollows and small valleys and the well watered slopes of low hills rather than the great plains and wide valleys that are today the rice granaries of the world. The utilization of extensive plains and broad river valleys for the cultivation of wet rice requires a social organization unknown to the peoples who first began wet-rice culture.

It is thought that the cultivation of wet rice originated in days when the hoe and the dibble stick were the only agricultural tools, that is, before the animal-drawn plow reached Southeastern Asia. The broadcasting of seeds is held to be characteristic of plow culture, whereas the cultivators of wet rice in Monsoon Asia generally plant their rice seedlings in the manner of shifting cultivators,[29] a circumstance that would seem to support the hypothesis that the carabao and the plow were not a part of the original technique but were adopted later. Even today wet rice is raised in some parts of Southeastern Asia without the use of the plow. For example, peoples in central Celebes prepare their fields for cultivation by driving carabaos back and forth until the fields are thoroughly puddled.[30] In other areas where wet-rice fields are built on such steep slopes that it is impossible to get carabaos to the terraces, farmers are frequently obliged to till their land entirely by hand—employing only such tools as wooden spades and sticks, which may be shod with iron. The Ifugaos of northern Luzon, for example, have terrace walls reaching, in some cases, heights of 60 feet or more that can be scaled only by means of rocks jutting out from the faces of the walls.

Although most sedentary cultivators in Southeastern Asia make use of

[29] Although rice growers in other parts of the world generally use the broadcast method of sowing, one finds it in Southeastern Asia only as a rare exception. According to Copeland (*op. cit.*, p. 224) the *subog*, or broadcasting method, is used in the Philippines over a rather limited area. This method produces lower yields but its advantages are "some saving of time, saving the labour of transplanting, and the possibility of maturing a crop with less water; rice grown directly in its place can get along with less water than transplanted rice." According to Kruyt ("De To Rongkong in Midden-Celebes," 1920, p. 380), the To Rongkong of central Celebes transplant their wet rice only in exceptional cases but usually broadcast it.

[30] Kruyt: "De To Seko in Midden-Celebes," 1920, p. 409.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL4

Although most sedentary cultivators in Southeastern Asia make use of the animal-drawn plow, in the densely populated regions the parcelling of land has proceeded so far that many peasants, whose fathers, or ancestors, owned draft animals (carabaos or oxen) and used plows, have farms so diminished in size that they cannot afford to keep draft animals and therefore must till their fields entirely with hand tools. In spite of the fact that they often make very intensive use of their fields, still they are not able to produce enough to meet the modest needs of their families.

241
231
311

In nearly all instances, however, where the governments concerned have attempted to solve this problem by opening up land suitable for sedentary cultivation to settlers coming from problem areas, the governments have been confronted by the fact that these districts, which might offer outlets for the congested areas, are inhabited by shifting cultivators or in some cases by food gatherers. The danger is then that the proposed migration may infringe upon the rights of the indigenous peoples, whose economy and mode of life, as we have noticed, require considerably more land than those of the incoming settlers, who are accustomed to permanent-field cultivation. It is, therefore, necessary for us to understand the various forms of land use in Southeastern Asia and their peculiar exigencies in order rationally to approach the problems of pioneering in the countries around the South China Sea.

311
241
166

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1
7/x [See pp. 35ff., category 241 or 116 -- Analyst]

Chapter II

THE SHIFTING CULTIVATOR [p. 16]

241 361 311

The field of the shifting cultivator is known by various local terms. It is called *caiñgin* in the Philippines, *humah* in Java, *ladang* in the Indies as a whole and in Malaya, *taungya* in Burma, *tamrai* in Thailand, and *rây* in Indochina.[1] Practically without exception, it is a clearing in either primeval or second-growth forest. The use of grassland is so unusual that we shall limit the following discussion to shifting cultivation on forest land.

As his name indicates, the shifting cultivator does not use the same piece of land every year; instead, he kills or cuts down at regular intervals —every year, every other year, or every third year—the trees of a small forest patch. He burns as much of the woody growth as is possible or convenient. Among the charred stumps and half-burned tree trunks he plants his favorite crops, be they cereals such as millet, upland rice, or maize; or tubers such as yams or sweet potatoes (Figs. 4–10). The latter [243 462] are planted extensively by the *caiñgero*, the shifting cultivator in the Philippines. In planting cereals it is usually the men who take the planting stick to make little holes and the women who drop in a few seeds, using their feet to cover the seed with soil (Figs. 11–13). [134] As forest land is generally free from weeds or grasses and the soil is usually rich in humus and well supplied with the ash of burned plant matter after clearing, it produces a very good, or even excellent, first harvest; the second harvest begins to show a decline in yield, and thereafter the returns diminish rapidly.[2] Grasses and weeds invade the clearing. Rather than battle these, the peasant abandons his old ladang and cuts and burns a new patch of forest (Fig. 15). The old plot reverts, under favorable conditions, to second-growth forest, the so-called *blukar* of the Malays, and is not cleared again for a period, the length of which may vary from 8 to 15 years, or more.

Shifting cultivation is characterized by a lack of tillage; the soil is hardly disturbed, as no plow turns it. There is less labor involved than in other methods of cultivation, and the work is more evenly spread over the year—an advantage where labor is relatively scarce. The tasks involved are cutting, burning, and planting; sometimes simple fencing of the field against animals, guarding—especially before the harvest and usually by women and children—and, finally, harvesting. In addition, there may be some weeding in the first year and certainly during the second.

---

[1] In British India *jhum*, *kumri*, *dhya*, *brwar*, or *dullet*; in Ceylon *chena*; in Japan, Korea, and Formosa *karen* (a Japanese term); in Central America *milpa*; in parts of Africa *chitemene*.

[2] Danhof reports for parts of the Lampoeng Districts that a ladang will produce from 15 to 25 quintals of rice in the first year and approximately 5 in the second year. In areas where the second yield shows such a serious decline the peasants usually prefer to make a new ladang—Danhof: "Bijdrage," 1940, p. 199.

1: Pelzer S-6 (1940-1941) 1945 AL1 Southeast Asia AL1
1 [See pp 39 ff., category 241 or 116.--
Analyst]

Shifting cultivation, the most primitive type of agriculture, may be briefly defined as an economy of which the main characteristics are rotation of fields rather than of crops; clearing by means of fire; absence of draft animals and of manuring; use of human labor only; employment of the dibble stick or hoe; short periods of soil occupancy alternating with long fallow periods. Other terms for shifting cultivation are field-forest economy and field-forest rotation.

Shifting cultivators prefer flat land, but in Formosa, the Philippines, Indochina, and Thailand they have been forced back into the hills and mountains and must often be content with fields on steep slopes (Figs. 16, 17). This has led some observers to believe that shifting cultivation is exclusively practiced in hilly or mountainous regions, or that such regions are preferred in this economy. However, in the Outer Islands[3] of the Netherlands Indies, one frequently finds ladangs in flat country (Fig. 18). If the ladang is very steep it is rarely used for more than one crop, so that new clearings must be made every year.

Many shifting cultivators no longer change their dwellings when they turn to new land; they have become sedentary at least as far as their houses are concerned. They may build a hut in the ladang if it is too far away from their village and may occasionally live in such a shelter, especially at the time when the ripening crop has to be guarded against animals, but they will return with the harvest to their permanent houses in the village (Figs. 10, 19–21).

Ladang culture, as is frequently true of any form of agriculture, is intricately interwoven with religion. Magic practices and sacrificial offerings must accompany every step in the culture, even if the people are no longer pagans but, for example, Mohammedans. Friedericy has made a careful study of these magical-religious customs in the Ponre mountains at the head of the Gulf of Bone in southern Celebes.[4] In this region the people live in small permanent villages. Whenever they are in need of new ladangs—every second year—the heads of the families meet to choose new locations. At this stage they try to find out from the spirits if these agree to the clearing of the land that was selected. For this purpose the village headman (*dukun*), or somebody else who is familiar with magic, is sent out to the part of the forest that has been chosen. Here the delegate places betel leaves (*Piper betle* L.), each with a small slab of lime and a piece of areca nut (*Areca catechu* L.), under a tree and expresses the desire of his community to cut the trees and to use the soil. He ends with the wish that the betel leaves and the areca nuts be scattered should the choice

[3] I have used the term "Outer Islands" to denote all the islands of the Netherlands Indies not comprised in the jurisdiction of Java and Madura (Madoera). The Dutch administrative term is *Buitengewesten*.

[4] Friedericy: "Ponre," 1932, pp. 1–34; idem: "De taak van het bestuur," 1937, pp. 488–501. For an excellent description of the magical-religious rites that are associated with the agricultural efforts of the Bemba of Northern Rhodesia, see Richards: Land, Labour and Diet in Northern Rhodesia, 1939, pp. 351–380.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL

241 787 of the new ladang be a poor one. After three days the same person returns, and if he finds that the offerings have been scattered a new location is chosen and a new attempt is made to get a favorable answer from the spirits. In case the betel leaves have been found undisturbed, all male members of the village have a meal on the chosen land. Then the area is divided among the villagers by the headman. Each individual appeals to the spirits by placing a betel leaf with lime and areca nut on the ladang that has been turned over to him. If the answer is unfavorable he tries again. The betel leaf may be placed three times. If the offering is disturbed each time, the headman turns over a part of his share, which is considerably larger than any of the others, to the less fortunate villager. Throughout the following agricultural year with its stages of clearing, planting, and harvesting, the peasant repeatedly requires the services of the dukun, or *shaman*, as well as the betel leaf.

In other regions details differ, but the essential fact remains that the social-religious life and thinking of the shifting cultivator is bound up with his characteristic form of cultivation.

423 241 621 Shifting cultivators have no concept of private land ownership. The land belongs to the community, the tribe, or the village, and each member has the right to use as much land as he needs and can cultivate. The location of the land that he is to use may be decided upon by the village council or the headman. The person who clears the land and plants the crop gets the produce. Nobody has the right to plant a plot that has been cleared by someone else. As soon as the land is abandoned all rights are forfeited, except the right of the community. However, if trees have been planted, the ownership of the trees and their produce remains with the person who planted them, and he is given preference when the land has had a sufficient fallow period and can again be cultivated.

The Effect of Shifting Cultivation on the Land

241 134 311 As has been stated above, ladangs decline in fertility after the first crop, and obnoxious grasses and weeds appear among the stooling tree stumps. As long as there is an abundance of forest land at his disposal the cultivator prefers to abandon the ladang. Under favorable conditions the grasses will, in turn, give way to second-growth forest. In the course of centuries this second-growth forest may develop into a climax forest, that is, a forest having the same composition as the primeval forest. In any case, when tall forest growth again occurs, the land will have had time to recover its original fertility.

Unfortunately, however, conditions are often not sufficiently favorable for a regeneration of soil fertility and the development of a good second-growth forest. As a matter of fact, the practice of shifting cultivation has altered the character of vegetation beyond recognition over wide areas in Southeastern Asia. Instead of a dense primeval rain-forest, we now find

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL4

241
134
311

extensive open grasslands resulting from the most important tool of the shifting cultivator, fire.

Generally, the fallow period allows time only for the evolution of mediocre second-growth forest, for the shifting cultivator usually returns to an old ladang before even a small percentage of those tree species that made up the original stand have had a chance to come back. Repeated cultivations further impoverish the forest and reduce the number of species. Certain light-loving trees that played a minor role in the climax forest will spread rapidly and dominate, together with those species that show a resistance to fire and those that are capable of sending new sprouts out of the old stumps.[5]

If fire repeatedly invades an abandoned ladang, the tree flora is reduced until finally only grasses and herbs survive. These persist because their root systems, tubers, or bulbs send out new shoots after the fire. The more important grasses and herbs that finally triumph over forest vegetation are *Imperata cylindrica* Beauv., *Imperata constricta* Hitchc., *Saccharum spontaneum* L., *Themeda gigantea* Hack, and *Eupatorium odoratum* L. These burn very rapidly and with a hot flame, even when still green. After they are well established they catch fire or are set afire every year, almost without exception; this prevents natural reforestation. Furthermore, the fire will also invade the neighboring forest and force it gradually back, so that the grass area steadily increases. This is especially true in hilly or mountainous country. In the Philippines about 18 per cent of the total area is covered with grass vegetation as a result of shifting cultivation and fires. These grass areas are known locally as *cogonales*. In the Indies, where they are called *alang-alang*,[6] they are also extensive, as in southern Sumatra. While I was traveling through southern Sumatra by rail during the dry season I counted twenty grass fires started within the space of an hour by sparks from our locomotive. In Thailand there is as yet very little cogonal land, according to Pendleton.[7] In Indochina culturally induced grasslands, either pure or with scattered trees—the latter called by the French *forêts claires* or *savanes-parcs*—are very extensive[8] (Figs. 23, 24).

[37]

Once the vegetation of an area has been changed from forest to grass, the land is of no more agricultural use to the shifting cultivator. The only benefit that he then gets out of the land is for hunting. For this, too, he often utilizes fire—either to drive wild animals out of hiding or to get a growth of young grass to attract his prey.

[224]

---

[5] In Malaya and Sumatra the spread of such bushes and trees as *Lantana camara* L., *Schima bancana* Miq., *Peronema canescens* Jack, *Vitex pubescens* Vahl, *Melastoma malabathricum* L., and *Lagerstroemia speciosa* Pers. is due to the cutting of clearings.

[6] *Imperata* (both *constricta* and *cylindrica*) is known in the Philippines by the Spanish term *cogon*, in the East Indies as *alang-alang*, and in Malaya as *lalang*. The last two are Malay words.

[7] Pendleton: "Some Interrelations between Agriculture and Forestry," 1939, p. 41.

[8] Gourou: L'utilisation du sol, 1940, pp. 368–372.

[See p. 38, cat. 241 or 116 -- Analyst]

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

When fires no longer ravage the grasslands, however, trees return and finally drive out the grasses completely, for the latter cannot stand shade.[9]

The spread of grass is especially rapid in regions with a long, pronounced dry season, whereas reforestation is more likely to take place in areas with a well distributed, high annual rainfall. This may explain why the Philippines and Indochina have a larger percentage of open grasslands than do Malaya and the Netherlands Indies.

A relatively high density of population is an important factor in preventing successful reforestation and encouraging grasses. In a thinly settled forest area there is sufficient land to allow for a long rest period, but an increasing density of population results in the shortening of the fallow period to such a degree that the soil is given insufficient time to recover its fertility. The shorter the fallow period the poorer the succeeding forest —if any—and the poorer the following crop yields, until finally the land can no longer satisfy the needs of the shifting cultivator.

Pendleton believes that this cycle may have contributed materially to the downfall of the Khmers in Cambodia (Cambodge). He states that although the Khmers used the plow on very limited areas of wet riceland, they had largely to depend on the planting stick and shifting cultivation for their food supply. As the demands for more food arose from the rapidly increasing population concentrated in the city of Angkor, the fallow period granted to the uplands had to be progressively shortened. At the same time fires became so frequent that culturally induced grasslands spread while the cultivable area decreased, thus further diminishing the food supply available to the people of Angkor. "While the actual fall of Angkor is ascribed to the superior military power of invaders, the resistance of the inhabitants was doubtless much less than it would have been had the lands been productive and they had had adequate supplies of food."[10]

Declining crop yields and the spread of grasses have been advanced as important reasons for the breakdown of the Mayan civilization,[11] and Pendleton further raises the question "whether the development of cogonals might not have been an important contributing factor in the dying out of some of the other civilizations of the tropics, notably that of Anuradapura, in Ceylon."[12]

Today the ruins of the Mayan cities, as well as those of Angkor, are surrounded by relatively luxuriant forest vegetation, which has had time to displace the pernicious grasses since man and his tool, fire, have abandoned the inhospitable grasslands.

Not only does shifting cultivation alter the character of the vegetation,

---

[9] When an old ladang remains unburned for several years the following trees spring up in addition to those already mentioned in footnote 5: *Erechthites hieracifolia* Rafin., *Blumea balsamifera* DC., *Peltophorum dasyrachis* Kurz, *Macaranga tanarius* Muell. Arg., and *Piper aduncum* L.

[10] Pendleton: *op. cit.*, pp. 46 and 47.

[11] Cook: "Milpa Agriculture," 1921, pp. 307–326.

[12] Pendleton: *op. cit.*, p. 47.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

Not only does shifting cultivation alter the character of the vegetation, 241 311 134
but also it may induce soil erosion, especially when it is practiced on slopes. Forest vegetation keeps the soil from being washed or blown away, but at the end of the dry season, when the trees have been cut and burned, the soil lies exposed. Consequently, during the early days of the rainy season large quantities of topsoil are washed downhill and carried by rivers to the plains. Erosion, by lowering the moisture-holding capacity of the soil as well as the rate of absorption, may thus cause further acceleration of run-off and lead finally to destructive floods on the plains. Such floods are frequent in the Philippines and parts of the East Indies. Pendleton points out that in Thailand the main rivers receive their great load of silt from the more steeply sloping mountains of northern Thailand where shifting cultivators have started the forces of accelerated erosion.[13]

The large quantities of valuable timber destroyed year after year by the shifting cultivators in virgin areas and the prevention of reforestation by the fires that spread through the abandoned fields (Fig. 22) cause the forester to regard the shifting cultivator as his enemy. In the Philippines the forester has for many years been pleading for strictly enforced laws and severe penalties against shifting cultivators.

> The greatest enemy of our forest is caingin making. It is to the persistent practice of this crude form of agriculture from time immemorial that the existence of vast areas of denuded waste lands is attributable. Much of our valuable timber has been and is still being wasted by this illegal form of forest clearing. There are actually over five and a half million hectares of open lands that are practically idle. Due to continued caingins and the recurrence of fires on these open lands, the forest area is decreasing year after year. . . . Destructive floods in various parts of the Islands and the yearly appearance . . . of locust pest, the extermination of which is costing the Government hundreds of thousands of pesos yearly, are chiefly the direct results of this obnoxious practice.[14]

Conflicting Views on the Merits of Shifting Cultivation 300

Judgments on the merits of shifting cultivation have been rather contradictory since the practice first came to the attention of scientific observers. During the past century the Dutch in Java spoke of it as *Raubbau* (robber economy), and one still finds the expression used. Sauer protests against this term. According to him, shifting cultivation is a "primitive economy, in which the per capita area of land needed for a community is rather large and in which the forest growth is to be considered as a part of a long term rotation of fields." He is of the opinion that it is "an excellent device for maintaining permanent productivity."[15]

Lord Hailey calls shifting cultivation "less a device of barbarism than a concession to the character of a soil which needs long periods for recovery and regeneration; and the trekking habit, whether of Dutch farmers

[13] Pendleton: "Soil Erosion in the Tropics," 1940, p. 757.
[14] Letter of the Director of the Bureau of Forestry to the Secretary of Justice, September 10, 1934.
[15] Sauer: "Destructive Exploitation," 1938, p. 496.

1 [See p. 38, cat. 241 or 116 -- Analyst]

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

always sufficient land for the population without undue pressure on the forests. A result of British rule has been to increase the population and correspondingly to reduce the rest period of the soil. The consequences have been deforestation and soil erosion. For that reason the authorities have attempted to stop this mode of land use.

In Java shifting cultivation attracted the attention of the government as early as the beginning of the nineteenth century. It was practiced especially in the mountains. The fact that a shifting cultivator required more land than a peasant who cultivated the same piece of land year after year made shifting cultivation extremely undesirable to a colonial administration that wanted to use all available land for the production of cash crops—either under the "forced culture system" of 1830 to 1870[21] or under the private plantation system that has existed since 1870. This circumstance, together with an alarming increase in population, prompted the government to do everything possible to stop the practice of shifting cultivation in Java, and today it is found only in the quite thinly settled residency of Bantam in West Java.[22] In the Outer Islands, with their sparse population and large forest areas, it is widely practiced. But, in contrast to their predecessors, Dutch officials of recent times rarely use the term *Raubbau* for shifting cultivation. Instead they consider this form of land use justifiable if the abandoned fields revert to forest and have the possibility of regaining their former fertility. In the past fifteen years, however, warning voices have pointed out that in large parts of the Outer Islands ladang culture has become a source of destruction, for the forest is no longer being given an opportunity to recuperate.[23] Both agricultural and forestry officials have consequently become concerned over shifting cultivation. In 1930 Hagreis presented a paper on ladang culture before the congress of officials of the Agricultural Advisory Service in the Netherlands Indies.[24] At that time it was decided to appoint a special commission to study ladang culture.[25] The foresters, also, devoted a good deal of attention to the problem during their congress in 1937. In 1940 Van Beukering of the Department of Economic Affairs summarized the result of the ladang *enquête*.[26] He came to the conclusion that shifting cultivation is a logical and economically justifiable form of land use wherever there is a large amount of land available and a primitive economy exists. From a social point of view no objection can be raised if, after each occupation, the fertility of the soil is regained. There is no reason to insist upon more intensive forms of land use so long as the population density does not increase beyond 50 persons per square kilometer, or 130 persons per square mile. If at this density we

21 From 1830 to 1870 the peasants of Java were forced, under the notorious "culture system," to devote part of their land and labor to producing crops for the government.
22 Kools: Hoeman's, 1935.
23 Gonggrijp: "Soil Management," 1938, pp. 397–404.
24 Hagreis: "Ladangbouw," 1930, pp. 43–75 and 629–642.
25 "Enquête betreffende het ladangvraagstuk," 1931, pp. 1022–1033.
26 Van Beukering: Het ladangvraagstuk. Unpublished typescript, 1940.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia-AL 1
Indonesia OB1

SEA
241
185
311

allow for five persons per family and assume that the family shifts its cultivation plot annually but returns to the same plot after an average period of 10 years, each family could occupy annually one hectare, or 2.47 acres. This is the amount of land that an average shifting cultivator in the Indies needs in order to cover the food requirements of his family.

This calculation does not make any allowance for permanent forests. Actually, however, the land requirements are not quite so high, because very often the same land is used for two years instead of one, which would either allow for a longer period of fallow or keep a part of the virgin forest intact. The latter is improbable because of the shifting cultivator's preference for virgin forest.

To summarize these opinions, shifting cultivation from the agricultural point of view is not considered objectionable so long as vegetation and the fertility of the soil are restored by nature. The opinion of those who regard it as a fatal agricultural system under all circumstances is widely felt to be unjustified. From the silvicultural point of view, shifting cultivation is held to be objectionable if it destroys timber that would otherwise be exploited by the forest service or by private concessionaries.

Supplementing Shifting Cultivation With Cash Crops in the Netherlands Indies

I
241
438
433

The products of the typical shifting cultivator never reach a distant market. There is seldom any surplus, for the shifting cultivator is a subsistence farmer who lives from hand to mouth. In the Outer Islands of the Netherlands Indies, however, the shifting cultivator has been drawn into modern economy and has modified this age-old system. In parts of Sumatra and Borneo he has begun to diversify his economy by planting tree crops on the ladang among his rice or maize. After one or two harvests the fields are abandoned and left to the trees that have been planted. The trees then furnish an additional source of income as soon as they reach the bearing stage. Pepper has been raised as a ladang crop for many centuries, especially in the Lampoeng Districts. Coffee was introduced in the days of the Dutch East India Company and adopted as a commercial crop by the peasants. Benzoin (*Styrax benzoin* Dryander), also, has long been grown in this manner. More recently coconuts and, since about 1905, rubber have become ladang crops (Figs. 25–33).[1]

I
[137]

A shifting cultivator may, over a period of years, convert his old ladangs into rubber gardens, for example, until he is assured of a sufficient income from his permanent tree crop to buy his food from the outside and no longer requires a ladang for the production of food. This process has led to the creation of the large native rubber areas in Borneo and Sumatra, where some shifting cultivators have become dependent upon the market price of rubber and upon the policy of the government in regard to taxation and export control. In times of low prices and export restrictions they may suffer severe economic setbacks and even hardship. In Bengkalis

[1] See p. 39ff, cat. 241 or 116 -- Analysis

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL 1

241
311
134
361

The Areal Extent of Shifting Cultivation in Southeastern Asia

It is difficult to form an idea of the areal extent of shifting cultivation because of its migratory nature and the fact that it is often practiced in remote regions. The only country of Southeastern Asia in which an attempt has been made to estimate the area used for shifting cultivation is the Netherlands Indies, but even there it was not possible to include all

Table II—Philippine Islands: Illegal Caiñgins Detected, 1914-1940

Year	Illegal caiñgins	
	Number	Area in hectares
1914	895	....
1915	1 198	....
1916	845	....
1917	665	....
1918	776	....
1919	603	....
1920	721	....
1921	1 602	1 429.48
1922	3 110	2 803.55
1923	1 759	1 516.33
1924	1 753	1 396.90
1925	1 762	1 391.29
1926	1 829	1 476.61
1927	2 002	1 743.92
1928	1 774	1 602.95
1929	1 312	1 370.41
1930	3 227	3 279.77
1931	2 534	3 345.74
1932	2 547	5 586.27
1933	2 427	2 831.38
1934	3 207	3 215.46
1935	2 631	2 455.73
1936	2 314	2 510.59
1937	1 967	2 308.24
1938	1 766	2 029.68
1939*	906	1 331.12
1940†	2 646	4 416.56
Total	48 778	48 071.98

Source: Data supplied by the Bureau of Forestry, Manila.
*Six months only, ending June 30, 1939, because of change of fiscal year.
†From July 1, 1939, to June 30, 1940.

parts of the Outer Islands in the estimate. Van Beukering concluded that one-third of all food consumed in the Outer Islands was grown on ladangs; this would require a total of 1,100,000 hectares of land. If we assume that all ladangs are occupied for 2 years and lie fallow for 12 years, the shifting cultivation system would need seven times 1,100,000, or 7,700,000, hectares. This estimate does not include the ladang area under coffee and pepper cultivation. (Rubber, coconut, and benzoin cannot be considered because they are, for practical purposes, permanent crops.)

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1
1/1 [See p. 26, category 241 or 116. -- Analyst]

241 311 134 361

Van Beukering allowed an additional 200,000 hectares for coffee and pepper ladangs; so that the total area amounts to about 8,000,000 hectares. If we assume that the population of the Outer Islands increases at the rate of 1½ to 2½ per cent each year, it would double in from 29 to 47 years. This would mean that after about 30 to 50 years 16,000,000 hectares would come within the scope of shifting cultivation.

In Malaya ladang cultivation is illegal, but it is practiced in the hinterland well away from roads and railways, in eastern sections of the peninsula. Dobby recently described it in Pahang and northeastern Kedah, near the Thai border.[30] The Sakai of Pahang regularly abandon their primitive huts as well as the clearings when they shift to a new field (Map, Fig. 2).1/1 The Malays of northeastern Kedah, on the other hand, as a rule live permanently in one place and change only their fields (Map, Fig. 3).1/1 There are no statistics available on the areal extent to which shifting cultivation is carried on in Malaya, but according to Dobby the system gives way to permanent culture "as the standard of cultivation rises and as the effect of law becomes stronger."[31]

In Thailand shifting cultivation is extensively practiced by the tribes of the mountains of the north and west, on the eastern part of the Khorat Plateau, and on the peninsula. Probably about 1,000,000 people depend upon it. According to the same kind of calculation that Van Beukering made for the Indies, a total of 1,400,000 hectares would be required, or 200,000 hectares annually, if we allow five persons per household and consider that one hectare covers the needs of a family for 2 years.[32]

[162]

In Indochina only the tribes of the mountains of Tongking, Laos, and Annam now practice rây, or shifting, cultivation. The people of the plains, Annamese and Cambodians, who represent 84 per cent of the population, practice a more intensive form of agriculture. Gourou has estimated the areal extent of shifting cultivation in Indochina. He states that a rây is used for 2 years and has to lie fallow for at least 20 years, which seems a rather long period as compared with other countries. In addition to its extensive plains, Indochina has a mountainous or hilly area of 580,000 square kilometers. Only one per cent of this land is permanently cultivated. Gourou estimates that about 40 per cent of the mountainous country is suitable for rây cultivation and he assumes that one-tenth of this, or 4 per cent of the total mountain land, is under rây cultivation in any one year.[33] If this calculation is correct it would mean that 23,200 square kilometers, or 2,320,000 hectares, are occupied annually by shifting cultivators. The numerical strength of the shifting tribes shows, however, that this estimate cannot be correct. Their number is not much greater than

[30] Dobby: "Settlement Patterns in Malaya," 1942, p. 222.
[31] *Ibid.*
[32] For an excellent description of the life of the shifting cultivators in Thailand, see Credner: Siam, 1935, pp. 148–173.
[33] Gourou: L'utilisation du sol, 1940, pp. 177–182, especially pp. 180 and 182.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1
[See p. 27, category 116. -- Analyst]

1,500,000, or at the most 2,000,000, which would mean about 300,000 to 400,000 households. This number of households could hardly occupy such a large rây area as Gourou assumes.

In Formosa only the Malay tribes of the mountains in the eastern half of the island practice shifting cultivation. They number, according to estimates, about 150,000. From this we may assume that not more than 30,000 to 50,000 hectares are occupied annually by shifting cultivators.

In the Philippines it is unlawful to make caiñgins on public land without the permission of the Bureau of Forestry.[34] Permission will be given if the forest on the land involved is of no commercial value and if the caiñgero accepts the obligation to reforest his patch with seeds supplied by the forest service. Several hundred caiñgeros are brought annually before the justices of the peace, who in the past, because their sympathy was with the caiñgeros, were usually rather reluctant to fine the culprits (Table II). Nobody knows, of course, how many illegal caiñgins escape detection, but it is certain that they greatly outnumber those that are made with the permission of the foresters added to those that have been brought to the attention of the courts. Special consideration is given to the "non-Christian" tribes, for whom tracts of land have been set aside within which they continue their age-old system of cultivation. In Mindanao probably three-fourths of the population, from the primitive Manobos to the more advanced Moros, practice the caiñgin system of cultivation. Other regions where this system is practiced extensively are Mindoro, Cebu, southern Negros, and parts of Luzon—the central and eastern cordillera and the Camarines. About 10 per cent of the population of the Philippines obtain a part or all of their food from caiñgins, most of which are made either on private land or on land that belongs to non-Christian tribes who know no other form of agriculture.

Methods of Eliminating the Undesirable Aspects of Shifting Cultivation

In regions where the density of population exceeds 50 persons per square kilometer, shifting cultivation becomes wasteful and destructive. It is imperative in such areas that the system be either modified or else replaced by more conserving and, where possible, more intensive forms of land use. For most backward tribes this involves fundamental changes in their mode of life, religious ideas, and concepts of land rights.

In some instances it should suffice to adopt measures that eliminate the harmful or wasteful after effects of the system without requiring that this kind of land use be given up completely. Let us assume that we have a somewhat thinly settled region containing a forest that is not particularly valuable and the exploitation of which is impracticable or at present inexpedient. Deforestation and the spread of grasses are undesirable aspects

[34] Nano: "Kaiñgin Laws," 1939, pp. 87–92.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

of shifting cultivation in the area. In such a case reforestation would be assured by keeping fire out of the old clearings. This could be done by leaving relatively non-inflammable forest belts at least 60 feet wide between individual clearings. These forest belts would offer some protection against the spread of grass fires and at the same time would be a source of seed for further reforestation. Reforestation under such circumstances would be much easier and cheaper than if large contiguous areas were to be cleared and used.

Where natural reforestation is particularly slow, cultivators should be required to practice artificial reforestation. In scattered regions in Southeastern Asia tribesmen do this on their own initiative. Pendleton reports such a case in Burma.[35] Certain Dyak tribes in Borneo plant seeds of the candlenut tree (*Aleurites moluccana* Willd.) about 3 meters apart in a freshly cleared ladang before it has even been burned. In the eastern part of the Malay Archipelago shifting cultivators plant such trees as *Aleurites moluccana* Willd., *Erythrina lithosperma* Miq., *Albizzia falcata* Backer, *Hibiscus similis* Bl., *Casuarina equisetifolia* L., *Macaranga* species, *Euphorbia* species, *Sesbania grandiflora* Pers., and *Desmodium timoriense* DC. for the purpose of restoring the forest.

In Sumatra Deli tobacco planters initiated artificial reforestation after alang-alang had regularly invaded their fallow fields and caught fire so frequently that second-growth forest could not get a start. In Deli the tobacco fields are in use only 1 year and lie fallow 7 to 10 years. They should be protected by forest growth during that period. Therefore, in order to make this possible, the planters controlled fires by planting belts of teak along the highways and roads. These belts served as fireguards and at the same time provided lumber for tobacco-drying sheds. On the tobacco fields themselves they planted especially *Albizzia falcata* Backer, *Cassia siamea* Lam., *Pithecellobium saman* Benth., and *Leucaena glauca* Benth., which drive out the alang-alang[36] (Figs. 34–39).

Another way of speeding up reforestation is to spare a few of the larger trees at the time of the clearing. This is done by the Malays of Sumatra. They do not cut down *Koompassia parvifolia* Prain, *Arenga saccharifera* Labill., *Durio zibethinus* Murr. (durian), *Parkia* species, or *Garcinia grandifolia* Pierre.[37] The last three are fruit trees that are numerous in the forest, whereas the second is a palm whose flower stalk is tapped for its sugary sap and the first is preferred by bees as a hiving tree, which gives it its name, "bee-tree." This tree is preserved because the people want the honey. Worthington reports that in Africa "some tribes appear to realize the necessity of maintaining tree growth on their clearings and merely top the trees and lop the branches, so that the trees are enabled to

[35] Similar cases are known in the residency of Benkoelen in Sumatra, in central Celebes, and in Flores. See Hagreis: "Ladangbouw," 1930, p. 631.
[36] Jochems: "De begroeiing der tabakslanden," n.d., pp. 77–89.
[37] *Ibid.*, pp. 30–32.

[See p 40 ff, cat. 116 --Analyst]

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL

244 137

na edulis Ker), sweet potato (*Ipomoea batatas* Poir.), taro (*Colocasia esculenta* Schott), *Curcuma* species, Goa bean (*Psophocarpus tetragonolobus* DC.), bitter cucumber (*Momordica charantia* L.), snake gourd (*Trichosanthes anguina* L.), Lima bean (large) (*Phaseolus lunatus* L.), Goa potato (*Dioscorea aculeata* L.), wild yam (*Dioscorea hispida* Dennst.), and sweet yam (*Dioscorea alata* L.). The middle story contains taller-growing plants, such as cassava (*Manihot utilissima* Pohl), citrus varieties such as *Citrus nobilis* Lour. and *Citrus aurantifolia* Swingle, papaya (*Carica papaya* L.), banana (*Musa* species), rose apple (*Eugenia aquea* Burm.), and soursop (*Anona muricata* L.). The upper story is formed by tall fruit trees, such as coconut (*Cocos nucifera* L.), jackfruit (*Artocarpus integra* Merr.), sapodilla or chico (*Achras zapota* L.), pomelo (*Citrus maxima* Merr.), of which numerous forms, differing in size and color, are known in the Indies, *belinju* (*Gnetum gnemon* L.), mango (*Mangifera indica* L.), durian (*Durio zibethinus* Murr.), candlenut tree (*Aleurites moluccana* Willd.), tamarind (*Tamarindus indica* L.), *pete* (*Parkia speciosa* Hassk.), stinkbean tree (*Pithecellobium lobatum* Benth.), and *santol* (*Sandoricum koetjape* Merr.).

This list does not by any means include all the plants that appear in the gardens. The plants vary in number and type from region to region in accordance with differences in soil, climate (elevation), and the taste of the owners.

●311 244 161 369

Estimates indicate that about 15 per cent of the cultivated land in Java and Madura is taken up by gardens. Unfortunately, there have been no detailed studies of garden culture outside of Java, although the products of the garden play an important role in the diet of all the peoples of Southeastern Asia. Terra, who compared garden culture in various districts of Java, found that the share of land allotted to gardens, together with the intensity of their cultivation, increases as the total amount of crop land per head decreases, down to the point where the average amount of crop land per head is only 0.15 hectare. Where the amount of land is even less than this the share of garden land decreases, although there is a tendency at first to increase the intensity of the garden culture. Close to the larger cities, the amount of crop land per person, together with the amount devoted to gardens and the intensity of the latter's cultivation, falls off to a minimum since the population here has supplementary sources of income.

With the development of a money economy appears a specialization that is directed toward the urban centers. There has always been some natural specialization inasmuch as some plants do not grow well everywhere. The coconut, for example, does best in the lowlands. But the new specialization depends not only upon such natural factors as soil and climate, but also upon economic factors such as marketing facilities and the development of communications. This specialization can be observed generally in Southeastern Asia.

146 244

Ochse and Terra found that in calories of food value the returns of the gardens proved to be slightly higher per hectare than those of the irri-

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL

ing crops. The process can be adapted to climate by manufacture either in shallow pits or low heaps."[64]

Dry-Field Crops Cultivated by Peasants

The list of dry-field crops cultivated in Southeastern Asia is rather large, but there are regional variations. Cassava, for example, is commonly grown on tegalans in Java (2,300,000 acres), whereas it is unimportant in Sumatra, Borneo, the Philippines (40,000 acres), Malaya (24,000 acres), and Indochina (75,000 acres). The most important dry-field crops are upland rice, maize, cassava, sweet potatoes, peanuts, soy beans and other pulses, tobacco, and sugar cane, all of which are annuals. Of the first four, only upland rice is a native of Southeastern Asia, whereas the other three are natives of the New World and were introduced into Southeastern Asia by the Spaniards in the sixteenth century.

TABLE IV—CHEMICAL COMPOSITION OF CASSAVA AND IMPORTANT CEREAL FLOURS

	CASSAVA (PER CENT)	MAIZE (PER CENT)	WHEAT (PER CENT)	RICE (PER CENT)
Moisture	10.75	13.41	13.65	13.12
Protein	0.87	7.56	12.35	9.85
Crude fat	1.19	2.79	1.75	0.88
Ash	1.24	1.78	1.81	1.51
Crude fiber	6.12	3.19	2.53	0.63
Carbohydrates	79.83	71.27	67.91	74.01

Source: The Cassava Industry in the Philippines, 1939, p. 7.

The inhabitants of Southeastern Asia have long relied upon root crops, fruits, leaves of various plants, and wild roots and tubers gathered in the forests, as well as upon rice. Scheltema refers to a number of early statements which indicate that "rice was not yet the principal food for a large portion of the native population [of Java] as late as the first part of the 19th century and that the rice diet has become much more important in the course of the past hundred years" as a result of the great extension of the cultivation of irrigated rice fields.[65] If it is correct that the rice consumption per capita increased during the past century, the opposite trend has been evident during the present century. For a while the increase in the area of irrigated land was great enough to allow for a larger rice production, but with the steadily increasing pressure of population the peasants now have to depend more and more upon unirrigated land. Thus the production of dry-field crops is gaining in importance.

Authorities in Southeastern Asia have been especially worried over the increase of cassava production and consumption. Because of the exhaustion of the soil fertility on many dry fields, the growing of upland rice and

[64] Worthington: Science in Africa, 1938, p. 387.
[65] Scheltema: The Food Consumption, 1936, p. 10.

1: Pelzer S-5 (1940-1941) 1945 AL1 Southeast Asia AL1

maize has become unprofitable, and many peasants have changed over to cassava, which makes lesser demands upon soil fertility. The per acre yields of cassava are high, and the plant is a source of carbohydrates, fat, and protein. From the standpoint of dietary needs, however, the ratio between carbohydrates on the one hand and protein and fat on the other is unfavorable. People who live on cassava merely fill their stomachs. The insufficiency of protein intake is detrimental to their health. Table IV compares the chemical composition of cassava, maize, wheat, and rice.

Maize, as the table indicates, compares quite favorably in protein content with wheat and rice and is especially rich in fat. It has gained an important position in the diet of the people of central and eastern Java, Madura, the island of Cebu, and the Cagayan Valley in the island of Luzon. Both maize and cassava are easy to store and therefore have a great advantage over sweet potatoes, which must be consumed soon after they ripen.

In Thailand maize is an important crop on the Khorat plateau and in other regions where dry land is available. Among the root crops cassava has gained a greater importance than taro and yams. The last two are grown mainly by Chinese gardeners in the neighborhood of large towns. Cassava, too, is grown commercially by Chinese, especially near the railroad on the peninsula.

Most of the so-called dry-field crops are grown in Indochina during the dry season on land that is flooded during the rainy season and at that time produces rice. Gourou has estimated that in Tongking 100,000 hectares of land are used exclusively for the production of dry-field crops and that 350,000 hectares of irrigated land are occupied by such crops during the dry season.[66]

This practice of growing dry-field crops on irrigated land during the dry season is especially widespread in Java, where population pressure is so great that the peasants have to use every possible means to enlarge their food supply. If there is not enough water available to grow a second wet-rice crop, they will always try to get a second harvest of quick-growing dry-field crops during the dry season.

In contrast to the peoples of Java, the Filipinos do not, as a rule, go in for the raising of dry-field crops on wet riceland during the dry season, although this should be possible if the land were cultivated. There is enough water in the soil a short distance below the surface for the growing of crops practically everywhere during the dry season. Repeated tilling would keep the soil soft and fine so that water could move upward by capillary action to replace that which is lost through evaporation. Cultivation would enable plants such as maize, peanuts, and soy beans to grow on land that otherwise would be baked dry and hard. Although the ratio between cultivated land and population in the Philippines does not make a dry-season crop a necessity in most regions, there are a number of districts where the peasants traditionally raise a dry-season crop on irrigated

[66] Gourou: Les paysans, 1936, pp. 407–408.

1[See page 75, cat 116 -- Analyst]

5: Dobby K-4 (no date) 1950 ALI Southeast Asia ALI

may induce flooding of the valley above the narrows. The Tasek Bera of Malaya in this way reflects constrictions in the Pahang Valley;

(*e*) the presence of levees means that the zone between them and the foothills has difficulty in draining to the river after a flood or during a downpour, so the levees are generally lined landwards by broad freshwater marshes, as by the rivers across the Korat Plateau in Siam (Fig. 90);

(*f*) where local rain seasons coincide with the arrival of spates, originating elsewhere in the local rivers, the landscape cannot shed the direct rainfall rapidly and it induces marshes.

Most of the freshwater marshes are seasonally flooded, drying out quickly in spells of drought, draining when local streams are low, but then flooding to depths up to 10 ft. during wet seasons.

Some types of swamp are man-induced. When alluvial mining is being carried on, dredges and gravel pumps effectively stir up large quantities of river sediment which is carried downstream as the mining effluent (Fig. 21).

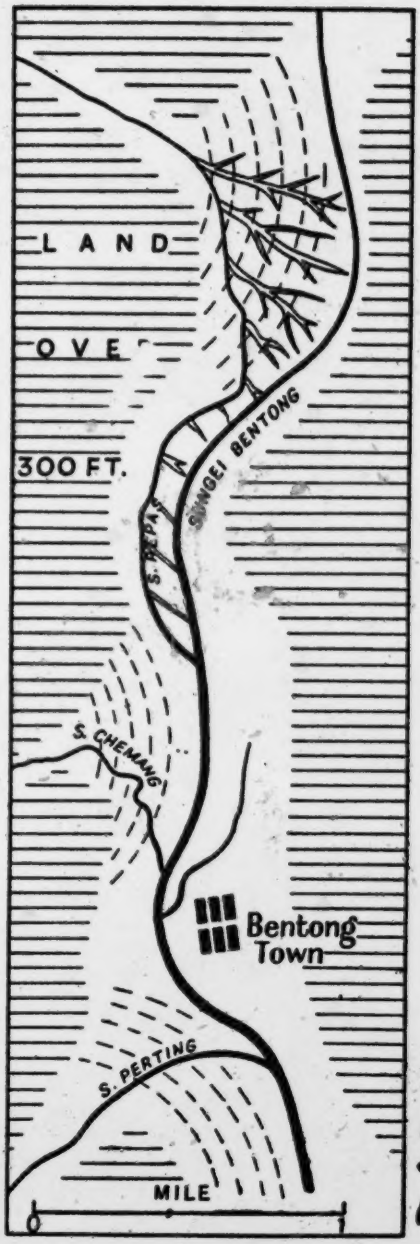

FIG. 21.—Alluvial Fans being thrust across Bentong Valley

5: Dobby K-4 (no date) 1950 ALl Southeast Asia ALl

311 This artificially stirred sediment is agriculturally negative and
133 it penetrates the ditches and drains of rice growing areas,
241 gradually silting them up, often spectacularly raising the
134 local river bed (at Serendah in Malaya, the river bed was raised 21 ft. by sedimentation over the decade 1923-33), as well as sterilising fields on which the silt spreads so that cultivation becomes more difficult as the river can no longer be kept out. The yields decrease and the fields are abandoned, swamp vegetation gradually obliterating signs of cultivation. Round the lower Malacca River may be found signs of the old field bundings within the tangle of swamp vegetation now growing there, a sign of the effects of mining higher in the river whose effluent is obliterating cultivation in lower areas. This type of swamp comes slowly and has all the appearance of nature overcoming men's efforts to farm, but it is fundamentally a result of man-induced erosions or abrasions elsewhere. Thus interference, by mining and forest clearing, with landforms stabilised over long periods, not only goes on by removal of silt and gravels carried from mining areas and topsoils removed by torrential rains on clean-weeded agricultural areas as a mark of transfer of surface materials from one area, but it also causes the obliteration of cultivation and an extension of useless marsh in the areas where this material is deposited.

133 Because these tropical marshes occur in zones of human signifi-
361 cance, that is, in the flatter areas with agricultural possibilities, and along the coasts where settlement from overseas might take place, they have played a major part in conditioning the distribution of human beings in Southeast Asia. Both the coastal and inland marshes are tree-covered, making it even more difficult to penetrate, control, or cultivate them. Varying degrees of swampiness often account for the ease of development of farming in one place rather than another in Southeast Asia and a broad belt of marsh has generally proved a greater human impediment than any other topographic feature.

5: Dobby K-4 (no date) 1950 ALl Southeast Asia ALl

Chapter Four

SOUTHEAST ASIA'S NATURAL VEGETATION

Tropical Forest Factors

The heavy, evenly distributed rainfall and constant high temperatures of most of Southeast Asia encourage continuous plant growth and a profuse, very varied flora. Because the whole year is here a growing season, plant life becomes almost overpowering in its rate of growth. This region contains more species than any other; the flora is not yet completely known, but some 35,000 species of flowering plants alone are thought to exist there (van Steenis). On Borneo at least 11,000 species have been listed, according to Merrill. This contrasts with the parallel figure of 13,000 species for the whole of Tropical West Africa (Good). Woody plants predominate and 15 per cent of the species are trees whose mature trunks are over 16 in. in diameter. The profusion of species is due to (*a*) the predominantly warm, moist climate, (*b*) the constancy of this climate over long geological periods, (*c*) the variety of relief and islands producing minor adaptations, (*d*) the rapidity with which selective and adaptive evolutionary processes can establish new characteristics in a tropical climate which has no resting season, and (*e*) the migrations of plant types from both Asia and Australia.

Southeast Asia was originally clothed by nature almost entirely by a tree cover. Only in modern times has there been any extensive clearing because apart from firing, primitive people were technically incapable of removing the forest. Some clearings became permanent for cultivation, in recent centuries, but the majority have been temporary and partial clearings, later left to natural replacement by a selective vegetation such as grass, savannah or scrub. Temporary clearings resulted largely from systems of shifting cultivation which finally abandon an area, partially cleared by fire, to a series of quick-growing plants, becoming after a few years a secondary forest which may, over prolonged periods, evolve to be scarcely distinguishable from primary forest.

The system of migrant agriculture or shifting cultivation, in Malaya called *ladang* and in Burma *taungya*, is widespread through-

5: Dobby K-4 (no date) 1950 ALl Southeast Asia ALl

[31 24] 137

out Southeast Asia and it may be this form of nomadism has in fact operated so long that it affects nearly every acre of the region, thereby exercising a distinct selective action on the whole forest (Sauer). Much forest which we call "primary" may be senile secondary. This is evident in more densely populated areas such as Java and Tonkin, and over the centuries may have no less influenced the forest types of even thinly populated zones, as Borneo still is. In this sense "primary forest" is a relative term, to be retained for convenience rather than as presupposing an absolutely virgin tropical forest.

Two main types of primary lowland forest may be distinguished, the critical factor being drought:

1. In those zones astride the Equator where no season may be called dry, the natural forest is a tall, leafy, congested and evergreen type known as Tropical Rain Forest, sometimes called Equatorial Rain Forest. It may even occur well away from the Equator, towards the northern limit of Southeast Asia, where certain local conditions create a more continuously wet climate than is normal for the latitude.
2. In localities where there are several consecutive months practically without rain, a shorter and more open forest type develops: it has deciduous foliage on the whole, and considerably fewer species. Deciduous Tropical Forest is more generally known as 'Monsoon Forest' and occurs over huge areas in eastern Java, Burma, Siam and Indochina.

Between these Tropical Rain Forests and Monsoon Forests, there are intermediate types and transitional areas where no single meteorological criterion can be used to define the boundary sharply. Within both types, local peculiarities of soil porosity, number of rain-days, relief, exposure and aspect all induce minor variations. In any given unit of this mountainous region, three zones of vegetation may be distinguished within both main forest types, these zones being more distinctive in their differences than the variations of vegetation from one part to another of this huge region. These zones are: (1) coastal vegetation, (2) lowland vegetation, (3) mountain vegetation.

(1) Coastal Vegetation

On shores predominantly sandy, short herbs, grasses and shrubs with creeping stems and fleshy leaves are found; these plant

18: Firth E-4 (no date) 1950 ALl Southeast Asia ALl

on the average, or only between one-third and one-half of the average in Japan.

Moreover, in any comparison between South East Asia and the peasantry of Europe, quite apart from differences in the production of crops other than the staple grain, there is an important difference in the average size of the holdings worked. The South East Asian peasant has fewer acres than the peasantry of Europe. In France, a country of peasant agriculture, about 40 per cent of the total number of agricultural holdings in 1931 were less than 2½ acres apiece; the average size of this group of holdings was 1½ acres each. But about 45 per cent of the total holdings were between 2½ and 22½ acres, with an average of about 10 acres each. There are areas in South East Asia where the average size of peasant holdings is fairly large. In Cochin China, while 72 per cent of the landowners have holdings between 2½ and 12 acres, there are provinces where more than half of them have holdings above 12 acres in size. In Siam, too, the average peasant holding seems of tolerable size—4 acres or so in the south and north east, 5½ acres in the north, and 10½ acres in central Siam, where more than one-third of the rural families live. But in Java, in 1938, the average size of holdings was only just over 2 acres for all tax-paying landowners in the country. In the Tonkin delta of Indo-China, another large area of heavy concentration of peasantry, as much as 60 per cent of the peasants have been reckoned to own holdings of less than nine-tenths of an acre, and 90 per cent to have holdings of under 4½ acres apiece. It has been estimated that a peasant family needs for adequate support 2½ to 5 acres of land, cultivating it by 'wet rice' methods. Many sections of the farming population in Java and Indo-China, for instance, are obviously well below this critical level. Even though large-scale irrigation and very intensive land use, including double cropping of rice in the year and much use of secondary crops, may lower the critical figure considerably, the peasant in such conditions is always liable to have to seek work outside his holding or to put up with inadequate living standards, even in nutrition.

The difficulties of agriculture in such conditions are further increased by the fact that a man's holding is often not a single undivided farm, but a set of dispersed fields, some of very small size. This dispersion and fragmentation of holdings allows for some advantages in adapting crops to soil and water variations, and is some security against wholesale raids by pests, but it makes for technical difficulties in the use of implements and labour on any scale. Since the dispersion is due primarily to traditional customs of inheritance and marriage, efforts to secure consolidation are apt to be only of temporary benefit, though some success has attended administrative action against undue fragmentation.

The same comparatively low level of productivity is seen in fishing, which gives the one great source of animal protein to the South East Asian peasant's diet. Before the war a Malay peasant fisherman produced on the average 1½ tons of fish per head per annum and in 1947 nearly 1 ton per